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ZOÖLOGY.

THE PROATLAS, ATLAS AND AXIS OF THE CROCODILIA.—I. *Proatlas.*—In all Crocodilia there is developed an osseous piece between the skull and the neurapophysis of the atlas. This piece is called "kleines niedriges Bogenstück" (Meckel[1]); "lame transverse" (Cuvier[2]); "oberes Schluss-Stück" (Stannius[3]); "oberer Bogen" (Bruch[4]); "Spinal — oder Dachstück" (Brühl[5]); "neural spine of the atlas" (Owen[6]); "proatlas" (Albrecht[7]); "postoccipital bones" (Marsh[8]).

Bruch (l. c., 1861) was the first to give the correct explanation of this piece, he *considers it as the neurapophysis of a vertebra, between the skull and the atlas.*

In 1880 Albrecht[9] reached the same result (l. c.).

Brühl and Marsh consider the elements in question as belonging to the skull: Dollo[10] has shown in extenso that this view is wrong, and that the "postoccipital bones" really represent the "proatlas" of Albrecht, and therefore parts of the vertebral column.

Eudes-Deslongchamps[11] says that it "représente l'arc postérieur de l'atlas chez l'homme."

Dollo (l. c.) has given a list of vertebrates in which the "proatlas" has been observed; it is not necessary to repeat it.

I have to add only some few points:

1. The proatlas is developed from two different cartilages exactly in the same way as all neurapophyses.

2. The two parts may be distinct in the young animals, and even in adult ones.[12] In a nearly ripe embryo of *Jacare vallifrons* I find two elongated osseous elements. In a young *Alligator*

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[1] Meckel, J. F. System der vergleichenden Anatomie, 2 ter Theil. Abth. 1, Halle, 1824, p. 430.

[2] Cuvier, G. Recherches sur les ossemens fossiles, Quatr. éd., Tome IX, pp. 192–193, Paris, 1836.

[3] Stannius, H. Lehrbuch der vergleichenden Anatomie der Wirbelthiere, Berlin, 1846, p. 134.

[4] Bruch, C. Vergleichende Osteologie des Rheinlachses, Mainz, 1861, p. 134.

[5] Brühl, C. B. Icones ad zootomiam illustrandam, Das Skelet der Krocodilinen, Wien, 1862, pp. 2–3.

[6] Owen, R. On the anatomy of Vertebrates, Vol. I, p. 65, London, 1866.

[7] Albrecht, P. Ueber den Proatlas, einen zwichen dem Occipitale und dem Atlas der amnioten Wirbelthiere gelegenen Wirbel, Zool. Anzeiger, 1880, p. 475.

[8] Marsh, O. C. Principal characters of American Jurassic Dinosaurs, Part VI. Restoration of Brontosaurus, Am. J. Sc., Vol. XXVI, Aug., 1883, pp. 82–83.

[9] It is generally believed that Albrecht first showed the true nature of these bones, but, as I have said, Bruch already had the same idea nearly twenty years before Albrecht.

[10] Dollo, L. Cinquieme note sur les Dinosauriens de Bernissart, Bull. Musée Roy. Hist. Nat. Belg., Tome III, 1884, pp. 129–135.

[11] Eudes-Deslongchamps. Mémoires sur les Téléosauricus de l'époque jurassique du département du Calvados. Mém. Soc. Linn. Normandie, Vol. XII, Caen, 1863, p. 43.

[12] Huxley, T. H. A manual of the anatomy of vertebrated animals. London, 1871, p. 251.

mississippiensis the bones are separate but not elongated as in Jacare. Usually the two elements unite early in the embryo.

3. It is possible that a proatlas existed in Rhynchosaurus Owen, a reptile very nearly allied to Sphenodon (Hatteria). Sphenodon has rudiments of the proatlas, as shown by Albrecht;[1] therefore the same bones ought to be present in Rhynchosaurus; this seems to be confirmed by a note by Owen[2] on this reptile.

"A small flattened triangular plate, which adhered to the posterior part of the skull, was suspected by Dr. Ward to be a tooth; it appeared to me, from the character of the exposed surface, to have at least equal claims to be regarded a dermal scute. In preparing the mold of the cranium this part was detached and lost, a circumstance which I have much regretted, since it prevented my applying to it the test of a microscopical examination."

In his detailed description of Rhynchosaurus, Owen[3] does not mention this point.

I believe it possible that the small flattened triangular plate, "which adhered to the posterior part of the skull," represents a piece of the proatlas.

It is probable that the proatlas is present also in the Protorosauria, which have many characters common with Sphenodon.

II. *Atlas and Axis.*—The centrum of the atlas is always represented by the odontoid process of the axis, and can be separated easily in the Crocodilia. The piece below the centrum of the atlas, supporting the neural arch of that vertebra, is the *hypapophysis*, between the proatlas and the atlas.

The hypapophysis between the atlas and axis is probably co-ossified with the anterior and lower part of the axis-centrum, as in birds and some dinosaurs. There seems to be a great confusion in the determination of the ribs belonging to the first vertebræ in the Crocodilia, and even about the true nature of these vertebræ. Koken[4] says, 1882: "Es ist erstaunlich und befremdend, wie sehr bei diesen sonst so conservativen Thieren die Ausbildung der ersten Halswirbel, und zwar in wesentlichen Punkten, differirt. Vorläufig erscheint es unmöglich, in Art und Reihenfolge der Veräenderungen eine Gesetzmässigkeit zu bringen."

This is very strange indeed. We find it very much more "befremdend," that Koken says (p. 808), that an alligator (*A.*

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[1] Albrecht, P. Note sur la présence d'un rudiment de proatlas sur un exemplaire de *Hatteria punctata* Gray. Bull. Mus. Roy. Hist. Nat. Belg., T. II, 1883, p. 190.

[2] Owen, R. Report Brit. Fossils, Rept. II; Brit. Assoc. Rep., 1841, p. 150.

[3] Owen, R. Description of an extinct lacertilian reptile (*Rhynchosaurus articeps* Owen) of which the bones and footprints characterize the upper new Red sandstone at Grinsill, near Shrewsbury. Cambr. Philos. Soc. Trans., VII, 1842, pp. 354–369.

[4] Koken, E. Die Reptilien der norddeutschen unteren Kreide. Zeitschrift Deutsch. Geol. Gesellsch. Jahrg, 1883, p. 808.

darwini) and a crocodile (*C. ebertsi*) *have no hypapophysis*, following Ludwig's[1] wrong description.

All reptiles possess the hypapophysis (unteres Schluss-stück) of the atlas, and it is quite injudicious that Ludwig and Koken could deny the existence of such an element in an alligator and a crocodile *from the Tertiary.*

The matter is very simple. Ludwig described the true hypapophysis of *A. darwini* as the centrum of the atlas; the axis centrum + the odontoid process as the centrum of the axis. Ludwig says that the odontoid process of the axis is wanting in *C. ebertsi,* but he describes it. He makes something very remarkable out of its separation from the axis. He did not find the hypophysis, and therefore he says this element is wanting.

There is no doubt whatever that the atlas and axis of Alligator darwini and Crocodilus ebertsi possessed the same structure as the living alligators and crocodiles.

Koken finds similar difficulties in the articulation of the ribs (p. 809). "Die zum Epistropheus gehörige Rippe ist bei den lebenden Crocodilinen gegabelt und gelenkt (nur mit dem Capitulum) zwischen Epistropheus und Dens Epistrophei, mehr am lezteren.

"Bei *Crocodilus ebertsi* ist sie ganz auf den Atlas-Körper übergegangen, bei *Alligator darwini* trägt degegen der Epistropheus die Rippe, bei beiden ist sie einfach.

"Bei Enaliosuchus setzt sich die einfache Rippe an die Diapophyse des Epistropheus, während die Parapophysen keine Rippen stützen.

"Bei Teleosaurus ist sie gegabelt und sowohl an Diapophyse wie Parapophyse inserirt.

"Bei Teleosaurus findet sich ferner ein drittes Rippenpaar, welches intervertebral zwischen Atlas-Körper und Epistropheus articulirt."

If these characters are true, we have to abandon the value of morphology. But we hope to show that the above statements are wrong or incorrect.

1. In the living crocodiles the rib of the axis shows the following conditions:

In *Gavialis gangeticus* the capitulum of the axis-rib articulates only with the centrum of the atlas. There is developed a rudimentary diapophysis in the neural arch of both sides. The tuberculum of the axis rib does not reach that diapophysis, but is probably connected with it by ligament.

In an adult *Alligator mississippiensis* the capitulum articulates with the atlas-center and by a *very small* face with the axis-center also. There is no trace of a diapophysis. The tuberculum does not reach either the axis or the atlas, but is connected with the *atlas* by ligament.

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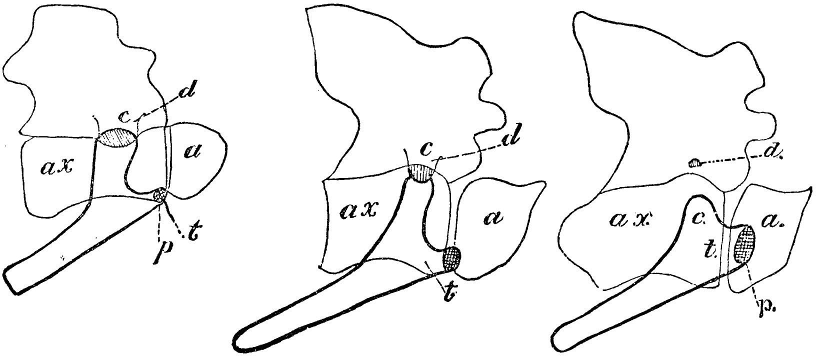
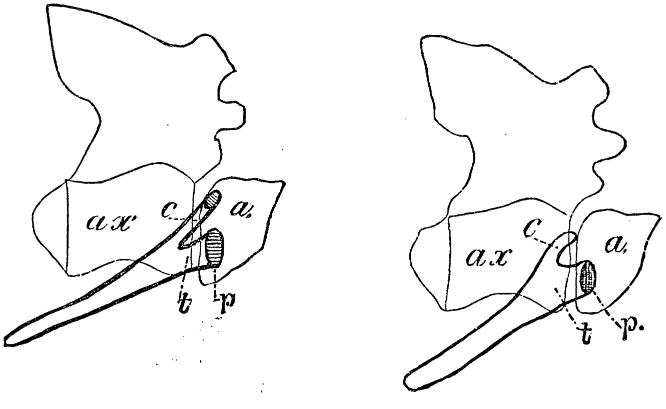
[1] Ludwig, R. Fossile Crocodiliden aus der Tertiaerformation des Mainzer Becken, Palaeontographica. Suppl. III, Lief. 4 u. 5, Cassel, 1877, pp. 13–14, p. 37.

Schematic Figures, showing the Relation of the Axis-rib to Atlas and Axis.



Teleosaur. Enaliosuchus. Gavial.



Alligator, young. Crocodilus.

a, atlas-centrum; *ax*, axis-centrum; *d*, diapophysis; *p*, parapophysis; *c*, capitulum; *t*, tuberculum.

In a very young *A. mississippiensis* the tuberculum is complete, and articulates with the atlas-center; the *capitulum* articulates with the same bone.

In *Crocodilus americanus* Schneid., the capitulum articulates with the atlas-center, the tuberculum touches the neurapophysis of the axis, but there is no face on that bone.

2. *Crocodilus ebertsi* shows the same conditions as *A. mississippiensis.*

In *Alligator darwini* the axis-rib is connected with the atlas-center. Ludwig, considering the atlas + axis as the axis, says that it articulates with the axis.

3. In the Enaliosuchus-axis a diapophysis is present. Koken believes that Enaliosuchus has a simple rib connected with this diapophysis. This can not be correct; if the diapophysis is present there must be an articulation for the tuberculum of the rib. The tuberculum never disappears before the capitulum. I believe that in Enaliosuchus (if it really belongs to the Crocodilia) a complete rib was developed in the axis, the capitulum articulating with the well-developed diapophysis, the tuberculum with the axis-centrum or with both the axis and atlas, or with the atlas alone. This face will probably be found if the atlas-rib is removed.

4. In the Teleosaurus-axis the diapophysis and the parapophysis are developed and the ribs two-headed.

Deslongchamps describes an additional rib connected with the atlas-center, but he figures no articular surface for this rib on the atlas. It is a morphological impossibility that a rib should exist between the ribs of the atlas, connected with the hypapophysis, and that of the *axis.*

At first when I saw Deslongchamps's figures I reached the conclusion that the axis-rib had entirely disappeared in the living Crocodilia, and that the *rib in question* represents the rib connected with the atlas-center (the true atlas-rib), but since I have shown that the axis-rib has not disappeared in the living Crocodilia, but is shifted in front of the axis successively, I must abandon this view.

Koken believes that the additional " rib " in Teleosaurus represents the tubercular part of the atlas-rib. This may be, but it is *not* probable. If the atlas and axis of the Parasuchia (Belodon, Stagonolepis) are known, we probably will get more light on this point.

I give the following results:

All crocodiles possess a hypapophysis (unteres Schluss-stück) of the atlas.

All crocodiles possess ribs of the atlas and ribs of the axis.

In the older crocodiles (Teleosaurus) the axis-rib has a well developed capitulum and tuberculum, the latter articulating with a well-devloped diapophysis. A similar condition is shown in Enaliosuchus from the Lower Cretaceous.

Later the diapophysis, and with it the capitulum, get rudimentary, the axis-rib loses its articulation with the axis and is shifted to the atlas.

This process is shown by the following diagram (relation of the axis-rib to the atlas and axis):

	Capitulum.	*Tuberculum.*	*Diapophysis.*	*"Parapophys."*
Teleosaurus.	articulating with " parapoph." of axis. (hypapophysis)	articulating with diapophysis	well developed	present on the anterior and lower part of axis (hypapophysis)
Enaliosuchus.	"	"	"	on the axis or atlas, or between them
Gav. gang.	articulating with "parapophysis"	rudimentary, connected by ligament with the rudim. diap.	rudimentary	present on the atlas-center
Allig. mississ. and other croc.	articulating with " parapophysis "	rudimentary, connected by ligament with the atlas or axis, if present connected with atlas	wanting	present on the atlas-center, partially on the axis

—*Dr. G. Baur, Yale College Museum, New Haven, Conn, Jan. 7, 1886.*

THREE PROBLEMATICAL GENERA OF MEXICAN BOÆFORM SNAKES.—Besides genera of typical Boidæ known to inhabit Mexico and Central America, three genera have been found whose position has been more or less uncertain. These are Charina Gray, Lichanura Cope, and Loxocemus Cope. All of them have been referred by one or another author to a supposed family Erycidæ, the type of which is the genus Eryx of India and Africa. This family has, however, no further definition than the non-prehensile character of its tail; in all other respects its members agree with the Boidæ. This prehensile character is, however, well known to be extremely evanescent in snakes, and to have no greater than generic value, and sometimes not even that. The tail of Lichanura can hardly be assigned to the one category more than to the other.

Some years ago I referred Loxocemus to the Pythonidæ, a course which has generally been adopted by authors; while the two others have been kept in the Erycidæ, Mr. Garman having gone so far as to unite them. An examination of the skeleton, however, shows that they all differ materially from each other, and must be referred to three separate families, viz., the Pythonidæ, the Boidæ and to the new family of the Charinidæ. The definitions of these families are as follows:

Supraorbital, postfrontal and coronoid bones present.................. *Pythonidæ.*
Postorbital and coronoid bones present; no supraorbital.................. *Boidæ.*
Neither postfrontal, supraorbital nor coronoid bones present............ *Charinidæ.*

—*E. D. Cope.*

NOTE ON THE PROBLEM OF SOARING BIRDS.—In the interesting paper on soaring birds, by I. Lancaster, published in Nos. 11 and 12 of the NATURALIST for 1885, the writer attributes the power which is utilized by the bird, no doubt correctly, to the condensation and expansion of the atmosphere, produced by the relative motion of the bird with respect to the atmosphere.

An evaluation, if it were practicable, of the excess of the upward, above the downward, atmospheric pressure upon the bird, when it soars horizontally or remains stationary on fixed wings, would show, no doubt, that such excess is exactly equal to the weight of the bird; and the rear expansion on a vertical section of a bird that remains stationary on fixed wing in a current of air, would be found to be exactly equal to the force exerted by the breeze. No other explanation of the phenomenon is conceivable, and this is substantially the explanation suggested by Mr. Lancaster. But he errs in his attempt to show that a bird can "soar" as a result of the action of gravity alone, without descending toward the earth, that is, without sacrificing its energy of position (potential energy). He has apparently been led into this error by a misconception of the phenomena of resultant motion, or by confounding force and motion; for he assumes that when a body is descending uniformly through the atmosphere and is therefore meeting with atmospheric resistance equal to its weight, it may, at the same time, by the action of an upward lateral force resulting from the condensation produced by its descent, have an upward lateral motion, so that its vertical ascent shall equal its vertical descent.

This is obviously a misinterpretation of the phenomena; for it is well known that the upward lateral force would arrest the downward motion, so that the *cause* of the upward motion would be immediately withdrawn; and besides, it leads to the absurd conclusion that the secondary effect of gravitation, through the condensation and expansion of air, may exceed that of its direct action.

Obviously the best the bird can do to sustain his elevation in still air, will be, by suitable position of his wings, to effect a *succession* of descents and ascents, thus utilizing, not only the condensation produced by his descent, but also the momentum acquired by his velocity.

It follows, therefore, that soaring birds utilize *two* forces, viz., gravity and the *motion* of the atmosphere, and that without atmospheric motion other than that produced by his descent, a soaring bird cannot for an instant maintain, undiminished, his energy of position.—*J. E. Hendricks, Des Moines, Iowa, Jan. 14, 1886.*

ON THE TYPES OF TOOTH-STRUCTURE IN MAMMALIA.—The trifid form of the lower molar of the genus Monachus and of Mesonyx is in reality repeated in the cusps of the molars of Ungulata generally. In Sus the second upper molar cusp[1] sends a long basal process forward and outward toward the canine cusp and may be said to represent the anterior cuspule of the trifid figure of the plan of cusp itself, while the posterior cuspule is aborted. The bicuspid cusp exhibits a small anterior cuspule which extends directly outward to reach the base of the canine cusp. Both the ridges formed by these cuspules are the first to become worn in mastication. This plan of arrangement is repeated in several extinct genera. among which may be mentioned Phenacodus and Hyracotherium.

In *Hyracotherium cuspidatum*[2] the cuspule is placed obliquely to the true molar cusp, precisely as in Gymnura, instead of being continuous with the cusp. The differences between the cusp and the oblique prolongation of the first molar cusp forward and inward being one of degree only.

In *Pliolophus vintanus*[3] the arrangement of the cusps appears to be exactly that of Sus. The only features which are lacking are those of the heel of the tooth and the shapes of the cusps themselves.

It may be said that the presence of ridges, especially of the oblique ridges, entering into the triturating surfaces of the tooth, relate to the survival of the small basal cuspules of the trifid figure. As may be easily supposed the direction of the ridges is subject to much variation. In man such direction is along a line which connects the first molar and the bicuspid cusps, and this arrangement appears again in Hippopotamus. In *Mastodon americanus* and Achænodon the cusps are without cuspules, which are seen only in aberrant examples of the last molars. In the former genus they have been figured by Leidy.[4]

The ridges representing the cuspules are unnamed in any regular manner by authors. They are said by Owen[5] to exist in the human tooth only. Leidy calls them the "accessory eminences," Cope[6] the "lesser tubercles," "crests," etc. They enter into the

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[1] The nomenclature of the cusps proposed by me in 1874 (*Dental Cosmos*, XVI, p. 617) is here followed.

[2] Cope. Wheeler's Survey, IV, p. 267, pl. LXV, fig. 18.

[3] Ibid, pl. LXV, fig. 1.

[4] Extinct Mammalia of Dakota and Nebraska, p. 245, pl. XXVII, f. 13, 15.

[5] Odontography, p. 453.

[6] Journ. of Acad. of Nat. Sci., 1874.

"interstitial" type of tooth of Ryder.[1] They constitute in part the intermediate (median denticules) cusps of Gaudry.[2] The object of the cuspule is to support the cusp, to the base of which it is attached. Indeed, it presents the first attempt to modify the bunodont type of dentition toward the lophodont type. It is consistently maintained only when the strain of impact is of moderate amount. Should the strain become excessive the lateral border of the tooth is arched inward, as first pointed out by Ryder.[3] In the presence of these strong arches or flutings the main surfaces of attrition no longer need the basal cusp supports and they disappear. This change is illustrated in Paleosyops and Limnohyus.

When a tooth becomes worn and an island of dentine appears at the summit of the cuspule it is often seen to be obliquely placed to the main cusp. This is occasionally seen in Achænodon and Mastodon and constantly in Hippopotamus. A key is in this way afforded to interpret the islands of the complex tooth of Phacochærus. Care should be taken not to be misled in applying this method of interpretation to intricate types of tooth-structure, such as Polymastodon and its allies, for in these genera there exist true cusps only (cuspules being entirely absent), and the third row of islands (when such exists) being simply a linear row of well-defined characters placed along the border of the tooth.

A tooth that has been for a long time subjected to the action of a dilute acid is entirely deprived of its enamel, and permits the superficies of the dentine to be clearly seen. It is of interest to note that the cusps upon the dentine of a tooth thus prepared, while corresponding in a general way to those on the free enamel surface, are sufficiently distinct therefrom to afford material for comparisons, and to suggest relationships of a different character from those determined by the study of the entire tooth. Thus the dentine cusps of the premolars of Sus suggest the form of the corresponding teeth in Monachus and of Mesonyx. The cusps of the third molar of Sus are strikingly like the molars of the Insectivora and of lower molars of the genus Bathyopsis. In like manner the dentinal surface of an aberrant molar tooth of man presents the essential features of teeth so remote as to recall the type seen in Centetes, Gymnura,[4] Chrysochloris, as well as in the numerous ancestral types described by Cope from the North American Eocene.[5]

A practical method of studying teeth with the object in view of determining lines of descent is thus presented. The enamel organ of generalized types it would seem furnishes groups of characters which are probably secondary in value (since the several parts of the organ indicate wide ranges of variation and of great adaptivity) to[1] those yielded by the modulations of the surfaces of the dentine.—*Harrison Allen.*

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[1] Proc. of Acad. of Natural Sciences, 1878, 45.

[2] Les Enchainements du Monde Animal, Paris, 1878, 70.

[3] Loc. cit.

[4] The arrangement seen in Sus is the same essentially as in Gymnura. The minute cuspule on the crown of the first upper molar is in precisely the same position as in Sus and, indeed, answers to it in every respect in the description of Mr. Dobson except that it is not connected to the anterior inner cusp as named by that author. It is a little curious that the dental formula of Gymnura is the same as in Sus.

[5] Report U. S. Geo. Sur. of Territory, III, 1884.

AN EXTRAORDINARY HUMAN DENTITION.—A gentleman living in Charles City, Iowa, recently exhibited to me the following remarkable dentition. To name the teeth from their forms, the formula would be as follows: I. $\frac{5}{4}$; C. $\frac{1}{2}$; Pm. $\frac{2}{0}$; M. $\frac{3}{3}\frac{3}{4}$. By position the formula would read thus: I. $\frac{5}{4}$; C. $\frac{1}{1}$; Pm. right side $\frac{2}{1}$; left side, $\frac{2}{\text{mol. temp. } 3}$; M. $\frac{3}{3}$. The first true molars in both jaws have a small accessory lobe on the inner side of the anterior inner tubercle. A brother of this gentleman has the following dental formula: I. $\frac{4}{4}$; C. $\frac{1}{1}$; Pm. $\frac{2}{1}$; M. $\frac{3}{3}$. A sister presents the following: I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pm. $\frac{2}{1}\frac{2}{2}$; M. $\frac{3}{3}$. A grandmother has the incisors $\frac{5}{4}$.—*E. D. Cope.*

ZOOLOGICAL NEWS.—*Echinodermata.*—H. Ayers, who has studied the sphæridia of Echinoids both at Cambridge and Banyuls, asserts (Quart. Jour. Mic. Sci., Nov., 1885) that these organs have great specialization of parts, especially of the nerve-cells, and that, as before considered probable by Lovén, the evidence at present is in favor of the view that they have the combined functions of taste and smell. Sounds do not appear to affect the sphæridia in the least, while the spines and pedicellariæ are at once affected, and the adjacent spines direct themselves toward the source of sound.——During the *Talisman* expedition fifty-four species of starfish were found, some from more than 4000 meters. Thirty-five of these species are new, and afford instructive combinations of characters.

Mollusca.—Paul Pelseneer (Quart. Jour. Mic. Sci., Oct., 1885) describes the cephalic appendages of Clione, Clionopsis and Pneumodermon. From this it appears that all these genera have two pairs of tentacles, the posterior with eyes; and that Clione and Pneumodermon are also possessed of buccal appendages, which in the latter genus are provided with suckers. The tentacles are probably homologous with those of ordinary gastropods. ——Professor Ray Lankester calls attention to the fact that sixtyfive years ago Mr. Benj. Gaillou made known the fact that the green coloring of the European oyster (*O. edulis*), is due to the fact that it feeds upon a diatom, the *Navicula ostrearia* Gaillou. This has been persistently ignored by the advocates of the copper theory, possibly because of the peculiar blue-green of the gill lamellæ, etc., of the oyster. The Navicula in question contains a blue-green pigment diffused through its protoplasm. This pigment is absorbed by the blood of the oyster from the contents of its alimentary canal, and collected by certain secretive cells which are limited to the surface of the branchiæ and the adoral face of the labial tentacles.

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[1] The more simple forms of teeth, such as those of the molar series of the peccary, show scarcely any differences between the enamel and the dentine surfaces, and it may be reasonably expected that the greatest contrasts will be seen in the teeth which present on the enamel the largest number of cuspules and cingula which bear rows of mammilations. The position of all small cusps between the four principal cusps of the bunodont molar, is either directly between the cusps or placed obliquely to them. When in the position first named they represent the highest degree of specialization attained by the molars of the carnivores, or they exhibit a tendency toward the development of the transverse ridge of the tapirodont type of tooth. When in the position last named the cuspule described above leads to the oblique crest seen in Palæotherium and its allies.

Arthropoda.—J. S. Kingsley contributes to the Quart. Jour. Mic. Science (Oct. 1885), some notes on the embryology of Limulus. He regards Limulus as an arachnid, but states that it takes us back to a time when the distinctions between the Crustacea and Arachnida were far less marked than now. He also describes the outlet in the embryo of the brick-red glands.——From an article in the Quart. Jour. Mic. Science, by Professor A. Sedgwick, it appears that there are two species of Peripatus, *P. capensis* and *balfouri.* The latter has eighteen pairs of fully developed legs, and is of smaller size than the better known species. The male organs of Peripatus are a couple of blind tubes, united near their termination. It does not appear that any portion can be extruded, and the spermatophores seem to be deposited upon any part, even on the head, of the female. Yet the uterus of the female, consisting of two tubes closely applied, is always full of embryos.

Fishes.—Dr. J. Beard gives, as the result of a continued study of the branchial sense organs in the Ichthyopsida (Quart. Jour. Mic. Sci., Nov. 1885), the conclusion that *at present we are acquainted with no invertebrate nervous system which is built upon the same plan as that of vertebrates.*

Birds.—Dr. Hans Gadow has examined the three species of Rhea. The long-billed appearance of *R. macrorhyncha* is due less to a larger, stronger bill than to a narrower and more slender skull. The three species have each thirty-three vertebræ from the atlas to and including the first primitive sacral vertebra, but *R. macrorhyncha* has one cervical vertebra more and one lumbar less than the other species. *R. darwini* is restricted to Eastern Patagonia and Southeastern Argentina; *R. macrorhyncha* to the provinces of Pernambuco and Bahia; while *R. americana* ranges from Bolivia and Matto Grosso to Uruguay, but does not seem to occur in the south-eastern provinces of Brazil. In *R. darwini* the neck is shortest, the forelimb longest, the toes longest, the bill shortest, the scutes on the metatarsus fewest. This is thus the most distinct species, yet the long neck and slender head of *R. macrorhyncha* are sufficient to distinguish it.——Mr. Sclater has described a new Phasianus from Northern Afghanistan. The wings have a patch of white, and the feathers of the belly are broadly tipped with bright purplish-black.——The third list of birds collected in Ecuador by M. Stolzmann contains twelve new species. L. Taczanowski and Count Berlepsch contribute the article (P. Z. S., 1885), and the latter appends some general considerations on the ornithology of Western Ecuador. This fauna now includes 468 species, besides eighty-five from Pichincha, Nanegal and Quito. Eastern Ecuador must be richer in birds, since Messrs. Sclater and Salvin state that Mr. Buckley collected nearly 800 species there. It also appears that there are but few species peculiar to Ecuador as a whole.——It appears from a note of Professor Owen, that the heart of the Apteryx has characters resembling those of Ornithorhynchus. This is especially the case with the auriculo-ventricular valve.

EMBRYOLOGY.[1]

The Development of Anurida maritima Guerin.—During the latter part of the summer of 1883 I had good opportunities to study the development of this interesting insect at Wood's Holl, Mass., where I found its ova, together with the parent insects, in great numbers under stones along the beach just below high-water mark. This appears to be the same species as is mentioned by Dr. Packard in the U. S. Fish Commission report for 1871 and '72, p. 544. The observations which I have been able to make relate entirely to such changes in the egg as may be noted with reflected and transmitted light, as I did not prepare sections of the eggs at the time. The accompanying plate represents several stages of the development of this type, and I have also figured the adult so that it may be compared with the genera Achorutes, Lipura, Anura, etc., to which it is obviously very nearly allied.

The adults are bluish-gray, and measure about 2.25^{mm} in length; ocelli ten, five on each side; no spring or elater developed in the full-grown insect.

The eggs are quite opaque, or practically so when observed with transmitted light, and measure .36 of a millimeter in diameter. They are dirty yellow in color and not white as are the eggs of Isotoma described by Dr. Packard in his memoir[2] on the development of that genus.

When the young Anurida first leaves the egg it strongly resembles Achorutes in the form of its body, as may be gathered from Figs. 3 and 4, and like the adults of that genus is whitish in color. The bluish, velvety appearance of the integument or cuticula which characterizes the adult does not appear to be developed until some days after hatching, or until one or more ecdyses have been accomplished. The eggs of this species are

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[1] Edited by John A. Ryder, Smithsonian Institution, Washington, D. C.

[2] Embryological studies on Diplax, Perithemis and the thysanurous genus Isotoma. Mem. Peabody Acad. Sciences, Vol. 1, No. 11, 1871, pp. 15–21, plate 3.